

tionally so. This concludes the series of five Januaries with negative pressure anomalies in Alaska.

It seems reasonable to conclude therefrom that low pressure in Alaska and the Aleutians is concomitant with

mild and rather dry weather in the United States, except that generous rains are probable in the Southeastern States.

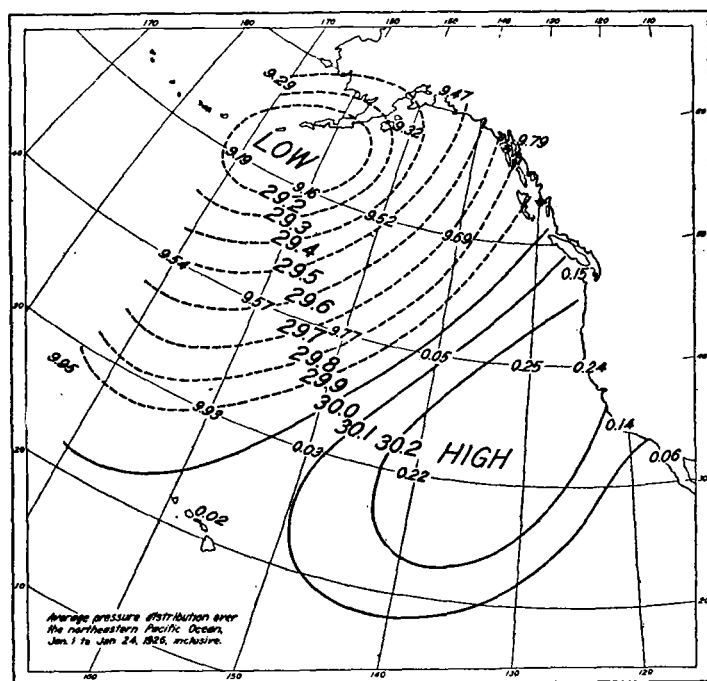


FIGURE 3.—Average pressure in inches over the northeastern Pacific January 1 to 24, 1926

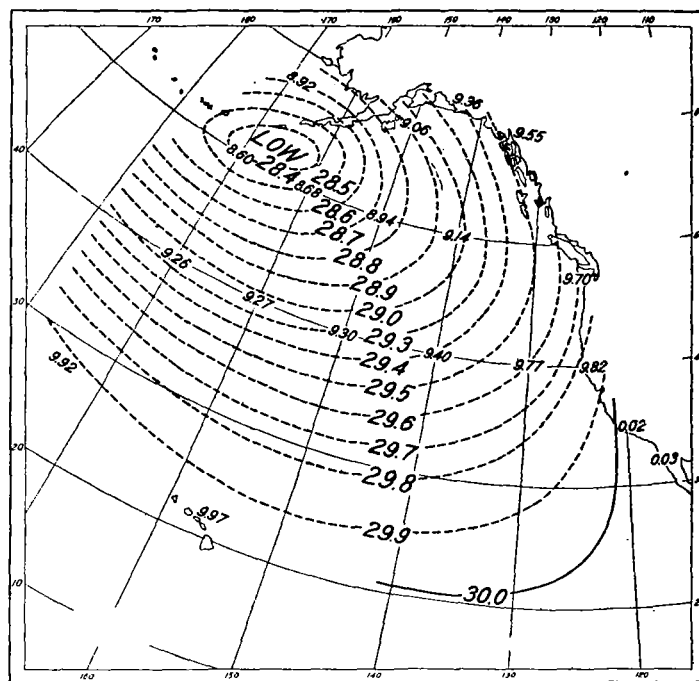


FIGURE 4.—Average pressure in inches over the northeastern Pacific January 25 to February 5, 1926

551.5: 523.4 (048)

NOTES, ABSTRACTS, AND REVIEWS

Some human aspects of astronomy (excerpts from a paper on "Modern Astronomy," by C. G. Abbot, in the *Annual Report of the Smithsonian Institution*, 1927, pp. 163-166. It has recently been observed that the illuminated side of Mars reaches equatorial temperatures approximating those of our spring days in Philadelphia. Both oxygen and water vapor have been demonstrated in the atmosphere of Mars, but in comparatively minute quantities. Adams and St. John find of oxygen 15 and of water vapor 5 per cent of the quantities prevailing in our atmosphere. So the Martian life, if it exists, must be adapted to atmospheric composition approximating that high above the summit of Mount Everest.

As the atmosphere of Mars is so very rare and dry, it is unsuitable to retain heat at night. Computation and observation unite in estimating the midnight temperatures of equatorial Mars as of the order of -40°C . These frigid night temperatures, combined with the rare and dry atmospheres, would seem to exclude from Mars the higher types of life, such as we know, but might permit certain arctic types to exist. Indeed, the seasonal changes of color which are observed, seem to many to be satisfactory evidence of vegetation on Mars.

Upon Venus there is no defect of temperature, or of the uniformity of it. With greater nearness to the sun but higher reflecting power, the solar radiation available to warm Venus is about one and four-tenths times as intense as that which warms the earth. Accordingly, temperatures approximating those of our Tropics should prevail in latitudes well toward this planet's poles. An abundant atmosphere is present. The reflecting power approximates that of a completely cloudy earth, so that

it would be reasonable to conceive of clouds of water, completely hiding the planet surface at all times.

The spectroscope, however, does not confirm this. Neither water vapor nor oxygen can certainly be discerned thereby. Yet it seems incredible that we see the surface of this planet, whose bulk must be solidified since its density is nearly the same as the earth's. For if solid, surely it would present some visible markings, and Venus never does. Accordingly, it is supposed that the clouds of Venus are of the high-level cirrus type, and that water vapor, though present plentifully below the clouds, is too scanty at higher levels to be revealed. As for oxygen, though certainly it can not extend as high as it does above the earth, it may be present beneath the cloud level.

No spectroscopic evidence of the rotation of Venus has ever been found. This proves that the planet does not rotate very rapidly, like the earth or Mars. It has even been suggested that, like the moon, its rotation and revolution periods are identical so that Venus would present the same face to the sun at all times. If that were so, the bright face would be very hot, and the dark face very cold. Recently, however, Pettit and Nicholson have found that the dark side of Venus is about equally warm from one edge to the other and is everywhere at about the same temperature that our earth would appear if viewed from another planet. This observation of moderate and equable night temperatures proves that the planetary rotation must be fairly rapid, and certainly not of the same period as the revolution. We may therefore conclude that Venus is very probably appropriately provided with temperature, humidity, and atmospheric conditions, and is in a state suited for luxuriant life.

Being wholly cloudy, however, it is doubtful if we can ever demonstrate it.

The earth, therefore, still remains the only known abode of life, and her life depends absolutely on the sun's radiation. Recent studies have shown that this dependence rests on very narrow margins of safety. For instance, the oxygen of the upper atmosphere is induced to combine into the form of ozone by the influence of extreme ultra-violet solar rays, and yet the ozone formed is continually being reconverted into oxygen by the influence of still other extreme ultra-violet solar rays. Thus occurs a balance of these effects such that the upper atmosphere contains so minute a quantity of ozone as would make, if brought to earth, a gaseous layer only as thick as a cardboard. Yet this minute and almost fortuitous atmospheric constituent cuts off entirely the spectrum of the sun and stars beyond wave length 2,900 Angstroms. The solar rays thus cut off, if they reached the earth, would destroy human sight and tissues by their powerful chemical activity. Of course, we could shield ourselves from these effects, but our ancestors who lived before the invention of spectacles would have lost their sight, or never attained it. Yet if the atmospheric ozone absorption reached only a little further, to 3,200 Angstroms, human and animal young would languish with the enfeebling disease of rickets, for the extreme ultra-violet rays are indispensable to proper mammalian growth.

As ozone absorbs to some extent even as far as 3,200 Angstroms, a catastrophe might ensue if circumstances led to a small increase of the ozone content of our atmosphere. For this would eliminate indispensable rays of wave lengths 2,900 to 3,200 Angstroms. Such a catastrophe would attend such an alteration in the distribution of the extreme ultra-violet solar spectrum as would change materially the existing balance of influences tending to produce and destroy ozone.

This leads us to inquire if the sun is a constant star, and, if not, what is the character of its variation. The fluctuations of sun spots and other visible solar phenomena which have long been known prove, of course, that the sun is not absolutely constant. Within the last 22 years the Smithsonian Institution has made some thousands of determinations of the intensity of solar heating, which prove that the solar radiation increases several per cent at times of maximum solar activity. Apparently, too, the sun's surface presents appreciable inequalities of radiating power, so that the rotation of the sun leads to successive brief changes of the intensity received at the earth's surface. These changes are slight for red and infra-red rays, but grow more and more considerable for the shorter wave lengths. Pettit, indeed, observing with the narrow band of ultra-violet rays which silver transmits, centering at 3,160 Angstroms, finds alterations of over 100 per cent in their intensity. This means that if our eyes were sensitive to such rays alone we should find the sun's surface twice as bright at some times as at others.

Other solar phenomena exhibit interesting variations. Nearly 20 years ago Hale discovered magnetism in sun spots, and later over the sun's whole surface. Sun spots are apt to go in pairs, and Hale finds that if the advancing spot of a pair is a north pole in the northern solar hemisphere, it will be a south pole which leads in a spot pair in the southern hemisphere. But this state of things endures only through one 11-year sun-spot cycle. In the following cycle these polarities reverse, so that $22\frac{1}{2}$ years are required to bring back the magnetic conditions to the starting point. Bjerknes has proposed an ingenious

hypothesis to account for sun spots, their coolness, their going in pairs, the opposite magnetic polarity of the pair, and the reversal of polarity at each 11-year cycle. It depends on hydrodynamic principles and explains the phenomena as due to causes residing within the sun, not to gravitational influences of the planets.

It is well known that terrestrial magnetism reacts to solar activity, and so does the aurora as well. Bauer has shown that the earth's magnetic state marches closely with the intensity of solar radiation as measured by the Smithsonian Institution. Very recently Austin has found that the reception of long-range radio signals also marches hand in hand with the intensity of solar radiation.

The weather, too, so important to human concerns, seems to be affected by solar changes. The importance of this effect is still in controversy, so that I shall not stress it, but merely remark that time will tell. However, I must point out that the solar variation, though obviously associated with the 11-year sun-spot cycle, has hitherto seemed irregular, and therefore unpredictable. But now there seem to appear definite periodicities of 25%, 15, and 11 months, and certain harmonics of these periods, which, together with the 11-year period seem to make up the whole long-interval solar variation. If these definite periodicities should persist, we shall be in position to forecast for years in advance the principal solar variation and everything which may be found to depend upon it.

I should give but a feeble impression of the importance of sunlight to life if I should stop at this point. All plants grow by absorbing solar energy and using it to promote chemical reactions in a way still inimitable by chemists. Ultra-violet rays, too, produce certain changes of chemical structure in fats and oils which are the source of those traces of hormones so extraordinarily important, all out of proportion to their infinitesimal occurrence, in the growth and health of animals. The more searching study of the solar spectrum in its relations to these extraordinary chemical reactions is a most fascinating field.

On the grosser side the application of solar energy to power production also offers an attractive research field. Some are disposed to think this chimerical. There are, however, certain lines of improvement over former attempts at the utilization of solar rays directly for power which, I am inclined to think, will solve the problem commercially.—C. F. B.

The distribution of mean annual maxima and minima of temperature over the globe.—Dr. C. E. P. Brooks and Miss G. L. Thorman, in Geophysical Memoir, No. 44 (British Meteorological Office, 1928), present isothermal charts of the mean annual maxima and minima, and tables of the means for stations in each 10 degrees of latitude, an arrangement like that of the Reseau Mondial. The charts and tables are based upon data for the years 1910 to 1921. The authors felt that a temperature record of this sort was needed for two main reasons—first, because the mean extremes give an idea of the temperature conditions to be met, roughly speaking, one year in two. And secondly, in order to minimize the possible instrumental error in recording absolute maxima or minima. Mean extremes also are, for different periods, more nearly comparable than the absolute extremes. In plotting the data no correction was made for the height of the station above sea level, because, where the variation of the mean annual maxima and minima with height was investigated at several stations in the western United States, India, and Switzerland, no regular decrease with height was found, similar to that which exists in mean tempera-